The missing piece in the jigsaw puzzle

A psycholinguistic account of the beginnings of the Coptic alphabet

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Past research approached the origins of the Coptic alphabet sociolinguistically and empirically. Neither can fully explain the comparatively sudden and fundamental change from a supraphonemic to a phonemic writing system for Egyptian around the second century AD. This paper adds the cognitive-linguistic concept of the grain size of a writing system to the picture. In essence, by the second century, sound changes in Egyptian had resulted in a phonological structure of the language that mapped more easily onto a phonemic writing system than previous stages of the language. This coincided with socio-political developments favouring the Greek alphabet. As a result, multiple writing systems, which shared the underlying structure, alphabetic, and model, the Greek alphabet, emerged. Eventually, one of these prevailed, the Coptic alphabet.

Keywords: sociolinguistics, psycholinguistics, grain size, phonology, community of practice, identity, functionality, Coptic, Egyptian

1. Language and script

In the later Roman period, a period of fundamental political, societal and cultural changes, an alphabetic writing system was first adopted to write the Egyptian language. The paper asks whether the adoption and subsequent adaptation of the Greek alphabet was a process of natural evolution (due to cognitive primes) or artificial creation (resulting from socio-political pressures), therein drawing a clear line between script and language and taking into consideration not only socio-political factors, which are primarily relevant to the early promotion of the new writing system, but more importantly, cognitive linguistic factors, which pertain to the origins of the change of writing systems.

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1.1 Script and language

We have to distinguish between a language as a fully-fledged system of communication, including a conceptual basis as well as a grammatical component and an output component influenced by a contextual component, to use Hengeveld and Mackenzie's (2008; 2014) terminology, and a script, which is in essence a graphic system to represent aspects of a language (Heselwood 2013: Chapter 1).

The fundamental difference between the two is that a language will develop naturally, both due to internal developments, such as sound change and grammaticalisation, and due to external influences, such as language contact, and will present a continuity over time, even if labelling sometimes obscures this. For example, labelling reflects a conscious distinction between Latin and Romance and between Romance and the modern Romance languages over time (Wright 2013). By contrast, a script is an initially artificially created system of representation, that may subsequently evolve more naturally. This system is in essence a reduction of the reality it represents, in that it cannot represent all the aspects of this reality but has to focus on a selection of them (Heselwood 2013: Chapter 1; Nolan 1990). The acoustic signal is too complex to be notated completely. However, completeness is not the primary concern of an orthographic system. It rather balances the issues of economy and practicability, that is a sign inventory that is usable rather than ideal (Esling 2013). The gaps that this system of representation leaves are filled by conventions that its users are familiar with.

Importantly, scripts and languages do not enter into any kind of one-to-one correspondence as not only our modern Latin alphabet, which is used for a large number of languages, but also the parallel use of several scripts to represent one language show. For example, as we will see, Egyptian was written with three writing systems for most of its history and modern Chinese is sometimes rendered with the Latin alphabet (Chappell 1980). Rather, scripts are independent systems that can be subjected to a range of interpretations regarding how sound and sign (form and meaning) correlate (this is what the field of semiotics studies in detail). They can be reinterpreted and modified (Heselwood 2013; Nolan 1990 on the International Phonetic Alphabet).

Writing systems are of different kinds.[1] Perfetti and Verhoeven (2017b: 23) distinguish five classes, that is syllabic, morpho-syllabic, alpha-syllabic, abjad and alphabetic writing systems. Syllabic and morphosyllabic / moraic writing systems map a supraphonemic unit, that is a syllable or a mora respectively, on a grapheme. The Japanese hiragana syllabary and the ancient Mycenaean Linear

1. Yet, opinions differ. For example, Daniels (2018: 136) sees syllabic systems at the origin of any script.

B syllabary are good examples (Miller 1994: 13–26). Alphasyllabic writing systems consist of signs representing consonants, which are supplemented by diacritics representing vowels. Modern Thai or Devanagari are good examples of this. Given the sound to grapheme mapping, we call these three classes of writing systems supraphonemic.

By contrast, abjads and alphabetic writing systems map a phonemic unit, that is a phoneme, on a grapheme. Thus, we call these classes of writing systems phonemic. In an abjad, the graphemes represent consonants and semi-vowels,[2] as in Hebrew or Arabic, whereas in an alphabet, the graphemes represent consonants, semi-vowels and vowels, as in the Latin or Greek alphabets.

What has been called logographic writing systems in the past can be understood as a subcategory of morphosyllabic writing systems, in that morphosyllabic units that have a meaning on their own are represented by a grapheme, as in modern Chinese or in parts in Classical Egyptian, for instance  *ḥr* 'face' (Ockinga 2012: 3). However, Classical Egyptian is a mixed system, in that units smaller and larger than a morphosyllabic unit could be mapped onto graphemes.

Applying these theoretical considerations to the Egyptian situation, two aspects must be noted. Firstly, while we have one Egyptian language developing over time and showing internal variety and diversification like any other language, for example in terms of register and genre, we have a number of writing systems that are used to write this language. For most of its history, Egyptian could even be written with more than one writing system. As a result, the last two diachronic stages of the language are traditionally referred to by the name of the writing system used in everyday contexts, that is non-specific contexts as opposed to the religious sphere or monumental inscriptions.[3] Hence, we speak of Demotic in the Ptolemaic and early Roman periods and of Coptic in the later Roman and early Byzantine periods. Throughout this paper, the term 'Egyptian' is used to refer to the language and 'Demotic' and 'Coptic' are used to refer to the writing systems. Secondly, Egyptian was written with a primarily supraphonemic writing system until the later Roman period, when we see a phonemic writing system take over. This is a fundamental change that requires explanation.

2. *Matres lectionis* are signs that hint at or indicate a vowel in writing systems that do not notate vowels consistently (Werning 2016; Hornkohl & Khan 2020).

3. An insightful discussion of the multitude of parameters that pertain to choosing a writing system and the grey areas where the choice lay with the scribe is Lipper and von Lieven (2016).

1.2 Previous research

Bagnall (2005) and Fournet (2019) considered the origins of the Coptic alphabet from a socio-historical perspective, in that they focused attention on the milieu from which the Coptic alphabet must have emerged, that is the early adopters.

Bagnall (2005) deems a priestly environment of some sort the most likely to have biscriptal and bilingual people that could draw on the resources of two languages and scripts, that is Greek and Egyptian, in order to revolutionise Egyptian writing. He concludes that the experimental strand of this new writing system that was used in Christian milieus must have won out in the end because of the growing power and importance of Christian environments.

Fournet (2019: 16 and chapter 4) draws attention to the fact that literary and epistolographic Coptic precedes documentary Coptic. These earliest uses of Coptic predate widespread Christianity (Choat 2012: 484–585) and thus lack Christian elements. Fournet goes on to note that the form of Coptic used in literary texts is a distinctive non-cursive as opposed to the Greek cursive.[4] He (2019: 26–39) furthermore draws attention to the difference between Egypt and Mesopotamia, where different scripts coexisted and all had a status, whereas Egyptian in Egypt became inacceptable in official (e.g. legal) contexts. Fournet (2019: Chapter 4) traces the advance of Coptic into non-literary, documentary contexts and notes that this took place primarily in monastic contexts.

From an empirical perspective, Quack (2017a) considered in great detail the practical route from (a) Graeco-Egyptian, that is using the Greek alphabet, to write Egyptian (comparable to the situation for Cyrillic and Chinese outlined in Section 5), through (b) late syllabic writing, that is using Demotic signs that represent syllables from the early Roman period onwards, (c) using the Greek alphabet with some additional signs adopted from Demotic to write glosses on texts, (d) alphabetic Demotic, that is using Demotic mono-consonantal signs to write magical spells, to (e) Old Coptic, that is using the Greek alphabet with some additional signs adapted from Demotic (comparable to the situation of using the Latin alphabet for English, French, German and Swedish, that is the core alphabet supplemented by varying sets of extra signs). Quack finds evidence for late syllabic writing from the beginning of Roman rule (in the first century BC) and evidence for Old Coptic at least from 100 AD onwards. This is in line with Choat (2006: 178–87, 2012: 584–85), who focuses on the documentary evidence in Christian and non-Christian contexts from the third century AD onwards. Torallas Tovar and Vierros (2019: 486–87) take this early evidence as sufficient to state that

4. Quack (2017a: 66), however, calls into question how sharp a boundary we should posit between Greek and Coptic.

'the Coptic script was standardised around the second century AD'. It seems however that these early texts rather reflect an experimental phase. Therefore, they are often termed pre-Coptic or Old Coptic.

The question that Quack leaves open is how exactly or rather why the shift from a supraphonemic to a phonemic writing system happened. He merely hints upon the possibility that this change was not purely due to socio-political pressures. It is there that the present paper picks up.

1.3 Aims and objectives

In essence, there are cognitive and socio-political factors for choosing one script or another. These factors result in practical realities. The socio-political factors and practical realities were investigated in detail in the past. The cognitive factors have not received the same amount of attention. They are one piece of evidence and cannot on their own explain the choice of a writing system, yet they seem to be the missing piece in the jigsaw puzzle.

Below, we review writing systems in Egypt (Section 2) and the cultural, political and social settings of later Roman and early Byzantine Egypt (Section 3) as well as the socio-linguistic aspects relating to the origins of the Coptic alphabet (Section 4) before delving into uncharted waters by considering the cognitive factors as to why one writing system may outperform another (Section 5). The final section puts all the pieces of our jigsaw puzzle together (Section 6).

2. Writing systems

From the earliest attestations of writing, Egypt has been home to several scripts used to write the native language (Section 2.1). Alongside, there were always minority writing systems including the Greek and Roman alphabets when settlers first arrived in Egypt (Section 2.2). In the later Roman and early Byzantine periods, the inherited writing systems of Egyptian were superseded by an alphabetic system, the Coptic alphabet (Section 2.3).

2.1 Supraphonemic writing systems

Houston, Baines and Cooper (2003: 440 and 442) speak of a triscript concept that runs through the history of Egyptian writing systems. The three scripts were a cursive primarily used for everyday writing, initially Hieratic and later Demotic; a script used primarily in religious texts, initially Cursive Hieroglyphic and later Hieratic and Demotic; and a script primarily used in monumental inscriptions,

Hieroglyphic all the way through.[5] This triscript concept relies on the complementary use of scripts depending on the genre and register of the text to be committed to writing. However, there were grey areas where apparently several scripts were acceptable.

What all the native Egyptian scripts share is their mapping principle between sound and sign. Supraphonemic units are mapped onto graphemes. The system combines consonantal, biconsonantal and triconsonantal phonograms with determinatives (Gardiner 1957: paras. 6, 17, 22, 23). Some phonograms represent a string of phonemes that constitutes a whole word. Vowels were not consistently written although some vowels could be hinted at (i.e. ꜣ ≈ /a/, j ≈ /i/, and w ≈ /u/) (Werning 2016: 31 and 43). Determinatives are added to a phonemically represented word in order to disambiguate the meaning. For example, the string *nb* can mean 'every' or 'lord', yet the writing disambiguates which meaning is intended:  'every' vs  'lord' (Ockinga 2012: 2).[6] The native Egyptian scripts differ in the level of abstraction of the signs. While we can recognise human beings, animals, and household utensils comparatively easily in Hieroglyphic, the level of abstraction in Demotic does not lend itself to this kind of recognition anymore: A1  (determinative 'man') vs ; G1 (ꜣ) vs  (never word-initial) and  (rarely word-final); W24  (nw) vs  .[7]

These writing systems developed and remained in use for more than a millennium. In the later Roman and early Byzantine periods, two things changed. Firstly, Quack (2017b) observes a regional diversification of Demotic palaeography. He notes that such a clear diversification cannot be observed for earlier periods and links the development to the decline of a central power that would, for example, control a school in the capital. Secondly, there was initially a proliferation of hieroglyphic signs, but this was followed by a gradual decline in scribes' competency as the less skilled use of hieroglyphic writing in the last attested instances shows (Houston, Baines & Cooper 2003: 440 and 445; Sternberg-El Hotabi 1994, 1999; von Lieven 2009).[8]

5. Von Lieven and Lippert (2016: 260) show that a perfect triscript system did not exist at all times but that there are short periods when two scripts were bearing all the weight.

6. Yet, 'lord' could be written without the determinative.

7. The numbers are according to Gardiner's sign list. The signs are taken from Johnson (2000).

8. The idea of gradual complexification by means of increasing virtuosity in using signs in all the native Egyptian scripts is elaborated by Stadler (2008), cf. unetymological writing styles.

2.2 Phonemic writing systems

In addition to the native writing systems, several phonemic writing systems existed in Egypt prior to the invention of the Coptic writing system. Bespoke writing systems were used by small communities and do not seem to have interfered with the native scripts.

Two small sample communities are the Jewish community on the island of Elephantine in the far south during the time of the early Greek settlements in Egypt (sixth to fourth centuries BC), who used the Aramaic abjad (Sachau 1911), and the largely Manichean village community of Kellis in the eastern desert during the later Roman and early Byzantine periods (third and fourth centuries AD), who left traces of the Syriac abjad in P. Kell. 1 67 (Gardner 2007).

With the arrival of Greek settlers (in the seventh century BC) and later Roman settlers (in the first century BC) in Egypt, the Greek and Latin alphabets entered the picture. While the Latin alphabet like the Latin language was limited to specific contexts, such as the army (Adams 2003), the Greek alphabet like the Greek language took root in the administration and in people's everyday lives. The Greek and Latin alphabets are phonemic scripts, which notate vowels, semivowels and consonants by means of a phonetic approximation (Heselwood 2013; Nolan 1990). In the early stages, neither the Latin nor the Greek alphabet interfered with the native scripts as the fact that local Greek alphabets do not seem to have served as the model for the Coptic alphabet shows.[9] Rather, the form of the Greek alphabet, primarily Ionic, that was current in the later Roman period apparently served as the model. This repertoire of graphemes and these pairings between grapheme and phonemic value are adopted and adapted.

2.3 The Coptic alphabet

The Koine Greek alphabet which the earliest adopters seem to have drawn on was not a good fit for the purpose of writing Egyptian primarily because the Greek and Egyptian phonemic repertoires differ. Some graphemes were only needed to write Greek loanwords, while graphemes for specifically Egyptian sounds did not exist. The process of adoption and subsequent adaptation of the Greek alphabet thus involved the stages of identifying the aspects to be remedied, experimenting with potential solutions to the issues identified and gradual standardisation.

9. Local Greek alphabets appear in use, e.g. in Naukratis, London BM 1888.6–1.531 (Wachter 2001: 215–19), Abu Simbel, e.g. Meiggs and Lewis n. 7.1–3 (Dillon 1997), both six century BC, and Memphis, P.Vindob.inv. G1.1–3, fourth century BC.

2.3.1 *Adoption*

The Coptic alphabet is an adaptation of the Greek alphabet. All twenty-four letters of the Greek alphabet along with the in-writing-obsolescent digamma were adopted.[10] Yet, several letters were not needed to write Egyptian words. For example, there is no distinction between voiced and voiceless dentals and gutturals in Egyptian (Coptic), thus the letters γ and δ were imported primarily to write Greek loanwords (Allen 2013; Horrocks 2014: 112). The same pertains to the letter ζ, originally representing /zd/ and then gradually /z/. Egyptian (Coptic) does not encode a phonemic contrast between voiceless (/s/) and voiced sibilants (/z/) (Horrocks 2014: 112 and 171). Digamma was imported for enumeration purposes. (1) provides an overview of the Coptic alphabet and the phonemic value assigned to each sign.

(1) The Coptic alphabet (phonemic values according to Layton (2011: vol. 20, paras. 8, 13))

ⲁ	ⲃ	ⲅ	ⲇ	ⲉ	ⲋ	ⲍ	ⲏ
/a/	/b/ (S); /v/ (B, A)[11]	/g/	/d/	/e/	–	/z/	/ē/
ⲑ	ⲓ	ⲕ	ⲗ	ⲙ	ⲛ	ⲝ	ⲟ
/t/+/h/	/y/	/k/	/l/	/m/	/n/	/k/+/s/	/o/
ⲡ	ⲣ	ⲥ	ⲧ	ⲩ / ⲟⲩ	ⲫ	ⲭ	ⲯ
/p/	/r/	/s/	/t/	/w/	/p/+/h/	/k/+/h/	/p/+/s/
ⲱ	ⳁ	ⳇ	ⳉ (B) / ⲅ (A)	ⲉ	ⳍ	ⳋ	ⳑ
/ō/	/š/	/f/	/x/	/h/	/č/	/kʸ/	/t/+/y/

(1) illustrates three aspects of the Coptic alphabet: Firstly, graphemes adapted from Demotic were added to the Greek inventory, that is ⳁ /š/, ⳇ /f/, ⳉ / ⲅ /x/, ⲉ /h/, ⳍ /č/, ⳋ /kʸ/ and the ligature ⳑ /t/+/y/ in the bottom row of the table in (1). Secondly, the exact shape of a grapheme can differ between dialects. Thirdly, the phonemic value of a grapheme can differ between dialects.

Notably, the form-function pairing of the graphemes β, (γ), θ, φ, and χ adopted in the Coptic alphabet seems to be that of the pre-Koine Greek alphabet as summarised in (2).

10. The grapheme digamma had fallen out of use before the Classical Greek period but was retained in Classical Greek in enumerations. This concept is taken over in the Coptic alphabet.

11. Coptic dialects: S = Sahidic, B = Bohairic, A = Akhmimic.

(2) Greek alphabet, developments (Horrocks 2014: 170)

Letter sign	Classical sound		Post-classical development	Approximate date of the change
β	voiced labial plosive (/b/)	→	voiced labial fricative (/v/)	by the 1st c. AD
γ	voiced guttural plosive (/g/)	→	voiced guttural fricative (/γ/)	probably already in the 2nd c. BC
θ	voiceless dental aspirate (/t^h/)	→	voiceless dental fricative (/θ/)	in regions other than Egypt, these represent a fricative at least by the end of the 4th c. AD
φ	voiceless labial aspirate (/p^h/)	→	voiceless labial fricative (/f/)	
χ	voiceless guttural aspirate (/k^h/)	→	voiceless guttural fricative (/x/)	

Thus, while the early adopters do not seem to have drawn on the Greek local alphabets, they seem to have adopted the form-function pairing of graphemes before the sound changes listed above took effect.

However, two aspects make it difficult to use the developments just shown as *termini ante quem* or *termini post quem*. Firstly, Dahlgren (2016, 2017) convincingly shows that at the phonetic level a regional variety of Greek in Egypt existed at least from the second century AD onwards. This regional variety seems to have been an instance of an indigenised link language (Adams 2003; Bubenik 1993), that is the link language Greek had taken on features of the indigenous language Egyptian. Horrocks (2014: 170) refers to this situation when wondering whether the fact that the classical voiceless aspirates had not become fricatives in Egypt was 'a conservative peculiarity of Egyptian Greek under the influence of Coptic' or represented 'a more general state of affairs in the Koine'. Secondly, the amount of data, and the number of preserved documentary texts in particular, is considerably larger for Egypt than for any other region. This complicates comparison of regions and thus the process of classifying a feature as a regionalism as opposed to a widespread Koine development. Thirdly and finally, differences between Coptic dialects play a role. For example, ⲃ is thought to be rendered as a voiced labial plosive in Sahidic in line with Classical Greek but a voiced labial fricative in Bohairic and Achmimic in line with Koine Greek. Achmimic and Bohairic, unlike Sahidic, have a sign representing a velar fricative (/x/) (Loprieno 1995: 41).

2.3.2 *Adaptation*

The earliest adopters faced the issue of not being able to notate all the Egyptian sounds. For this reason, a number of Demotic graphemes were adapted and added to the adopted alphabet. This situation is illustrated in the alphabetarium Verso of P. Duk. inv. 232 = T. Duk. inv. 7 (7th / 8th centuries AD), in which the letters adopted from Greek and the letters adapted from Demotic are separated (see also Clackson 2010: 88; Cribiore 1996: catalogue n. 92 (7th/8th c. AD), 1999: 282).[12] The Greek-derived letters are on the bottom of the tablet (from left to right); the added letters are on the right-hand side (from top to bottom, Demotic-derived ⳩ /š/, ⳧ /f/, ⳉ /h/, ⳇ /k^y/, ⳍ /č/, the ligature ⳑ /ti/, and the christogram ⳕ).

The number of extra graphemes is not entirely fixed especially in the earliest phase and remains fluctuating due to regional variation. An example is the London-Leiden Magical Papyrus (pLeiden I 383 + BM 10070) which dates from the end of the second or the beginning of the third century. Here, we find twelve additional Demotic-derived signs (Dieleman 2005: 71–72; Richter 2009 for further references).[13] Quack (2017a: 52–54) explains in detail the inventory of Demotic-derived signs. Notably, due to phonological changes and system-inherent graphic alternatives, often more than one Demotic candidate existed to render a sound.

Not only the number of Demotic-derived letters that were added to the Greek alphabet varied, but also their shape. An example is the Old Coptic ostracon from Kellis which dates from the third century (Gardner 1999: 197) containing the Demotic-derived letters ⳩ /š/, ⳧ /f/, ⳋ /x/, ⳍ /č/, ⳉ (?) /h/, and ⳇ (?) /k^y/. Especially for the latter two, Gardner (1999) notes that the shapes that appear on the ostracon cannot readily be associated with the shapes that were to become the standard. Only contextual inference suggests that the letter shapes found on the ostracon are to be taken as early equivalents of later ⳉ and ⳇ. Quack (2017a: 72–73) explains the letter shapes, on the one hand, as based on graphic alternatives in Demotic and, on the other hand, as based on the fact that due to phonological changes one could select from multiple Demotic signs when choosing a model for the derived Coptic grapheme. Quack identifies the writing tradition in Kellis as a distinct one.

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12. Image: https://library.duke.edu/rubenstein/scriptorium/papyrus/images/150dpi/232v-at150.gif (last accessed: 15.04.2020).

13. The alphabetic script was used to provide glosses for Demotic signs. Since the correct pronunciation in a magical spell is of the utmost importance, the writers may have been more prone to adapting a large number of Demotic signs in order to represent nuances of pronunciation.

The variability in both shape and number of the Demotic-derived signs that were added to the adopted alphabet suggest an experimental phase. The early adopters seem to have experimented in order to find the sufficient and necessary number of signs to be added to the Greek alphabet in order to use it successfully to write Egyptian. They were apparently able to draw on knowledge of the Greek and Egyptian languages and even more importantly of the Greek and Demotic scripts.

2.3.3 *Standardisation*

While the extent of fluctuation in shape and number of the additional Demotic-derived signs decreased, local Egyptian alphabets retained some fluctuation. For example, compare the number and shape of Demotic-derived signs for the Sahidic, Bohairic and Akhmimic dialects.

(3) Demotic-derived signs in local alphabets
Sahidic : ⳩ /š/, ⳇ /f/, ⲋ /h/, ⲭ /č/, ⲯ /ky/, ⲧ /ti/
Bohairic : ⳩ /š/, ⳇ /f/, ⲋ /h/, ⲭ /č/, ⲯ /ky/, ⲧ /ti/, ⳉ /x/
Akhmimic : ⳩ /š/, ⳇ /f/, ⲋ /h/, ⲭ /č/, ⲯ /ky/, ⲧ /ti/, ⲽ /x/

In the Bohairic and Akhmimic alphabets, a larger number of Demotic-derived signs is present than in the Sahidic alphabet (Müller forthcoming). In the Akhmimic alphabet, the shape of the sign for a velar fricative markedly differs from its Bohairic counterpart (Till 1928).[14]

These observations resemble Quack's (2017b) observation regarding the regional diversification of writing systems in the Roman period. Apparently, education had become decentralised and thus local educational centres developed their own traditions of writing. Compare the archaic Greek local alphabets for a similar situation. The monographs φ, χ, and ψ had different phonemic values in local alphabets and the number and shape of letters in local alphabets varied (Jeffery 1990). The Koine Greek alphabet is the result of a gradual process of centralisation and levelling of differences. By and large, it seems that in the initial phase of adapting an alphabet (Papadopoulos 2016 on the adaptation of the Phoenician alphabet by Greek speakers), the needs of the local language variety are prioritised. With the rise of a Koine or a standard variety (Bubenik 1993; Colvin 2009), the local needs become subordinate to the needs of this Koine or standard variety.

14. An anonymous reviewer pointed out to me that the Bohairic shape is based on a special Demotic sign, whereas the Akhmimic shape is that of the /h/ with a diacritic stroke.

3. Situational contexts

The later Roman and early Byzantine periods saw significant changes in the Egyptian society in political (Section 3.1), linguistic (Section 3.2) and cultural terms (Section 3.3). While the situational settings of previous periods seem to have favoured the downward trend of the inherited language and script in the written record, the changes characterising the later Roman and early Byzantine periods seem to have reversed this situation, in that Egyptian was on an upward trend and a new script was created to commit the language to writing.

3.1 Socio-political circumstances

Politically, the Roman provincial administration had been based in Egypt and staffed with speakers of Greek and Egyptian, certainly in the early Roman period. The beginning of the early Byzantine period saw Egypt transitioning from being a province of the Roman empire to being part of a diocese of the Byzantine empire (Palme 2007).[15] When compared to the Roman province, the Byzantine diocese covered a larger area and there seems to have been a laxer attitude towards centralised control. This is apparent, for example, in the legal sphere. While Roman law dictated that Roman citizens' wills be written in Latin, after the *Constitutio Antoniniana* every inhabitant of the Roman empire was a citizen (Jördens 2012). Most of them were previously obliged to use the non-Roman format for wills. Garel and Nowak (2017) show in detail that not only the permissible language(s) in wills changed when the distinction between Roman and non-Roman formats became an aspect of the past, but also the structure and the circumstantial requirements for validating a will.

Societally speaking, Torallas Tovar (2004a: 164, 2010a: 255) suggests that the earliest encounters between Greeks and Egyptians were characterised by division, as evident in the development of a pidgin.[16] Yet by the Roman period, this division had been replaced by fluidity between the once distinct groups. Depauw and Coussement (2014) show how naming practices reflect this and Kraus (2000) argues that ethnic divisions had been superseded by a social-class system based on wealth. The metropoleis in particular were melting pots where people from a range of backgrounds interacted.

15. Pestman and Groningen (1994: 12) set Dioclectian's becoming emperor as the beginning of a new era, yet his administrative reform is debated.

16. A pidgin is a reduced language variety that is intended for day-to-day (necessary) communication between two groups of speakers that do not share a language.

Economically, not only in smaller cities and villages but eventually also in cities like Alexandria, the building activity was becoming more modest (Keenan 2007 (villages); Kiss 2007 (Alexandria); van Minnen 2007 (other cities)). This suggests economic recess. The defence system against external powers successfully prevented large-scale attacks until the arrival of the Sassanids in the early seventh century AD (Foss 2003; Sänger 2011).

By and large, we see a region at a crossroads with the central government losing power and local institutions gaining power. These local institutions are public institutions such as schools (Quack 2017b) and clerical institutions (Fournet 2019: Chapter 4; Wipszycka 2007). Furthermore, smaller local groups could establish more close-knit social networks than before because they had more freedom to organise themselves. An example is the Manichaean community in Kellis already mentioned.

3.2 Socio-linguistic circumstances

Matras (2009: Chapter 3) lists three aspects as essential in maintaining societal multilingualism. For a language to stand its ground in a multilingual setting, it needs a writing system, educational backing, and political backing.

Bagnall (1993: 236–37) claimed that there was no native writing system for Egyptian between the middle of the second and the beginning of the fourth century AD. More recent studies, especially by Quack and Choat (see Section 1.2), have shown that this gap did not exist but that an alphabetic writing system was fully functional at the very latest by 100 AD (Quack 2017a: 61). Nonetheless, by this time, the Greek alphabet was an established and fully developed writing system, whereas the Coptic alphabet was in its infancy.

On the educational stage, while the temples had previously been educational centres for Egyptian, financial support for these from the government ran out in the later Roman and early Byzantine periods (Cribiore 2001: 22–23; Houston, Baines & Cooper 2003; Torallas Tovar 2010b: 32–33). The government could not continue spending significant amounts of money on providing education in Greek either (Maehler 1983 on earlier periods), but monasteries took over (Bucking 2012 (Deir el-Bahri, Beni Hassan); Choat 2009: 347–49; Cribiore 2001: 23–24 (Beni Hassan, Thebes, Epiphanius, St. Phoibammon)). Thus, education in Greek was more easily accessible than education in Egyptian.

Political backing means that a language is acceptable in official contexts up to the highest level. This is closely related to the issue of diglossia. The traditional definition of diglossia assigns the labels H(igh) and L(ow) to two languages that are used alongside each other (Colvin 2009: 36 n. 9; Crespo 2007: 40–41) across domains of language usage (Palme 2009 on private vs. official in Egypt). More

recently, Adams (2003: 593–597) has shown how difficult the assignment of these labels is already in Roman Egypt using the example of the soldier Terentianus, who knew Greek and Latin. This is partly because languages often do not have clear-cut functional profiles and partly because the assignment of labels is not the same at the societal, group and personal levels. Nonetheless, the general concept of diglossia remains useful, in that in multilingual settings languages are often assigned to different functional domains at the societal level (Matras 2009: 44–53). It then matters which language is acceptable in the domain of official governmental dealings and business. For Egypt, Depauw (2012) hypothesises that the Egyptian everyday language and script were denied this status already in the Roman period using the example of the stele of Cornelius Gallus (29 BC), which shows inscriptions in Greek, Latin and Hieroglyphs but not in Demotic. The traditional hieroglyphs were only used to broadcast Roman accommodation to Egyptian culture. The Greek summaries of Demotic contracts that became compulsory seem to confirm his hypothesis (Depauw 2009).

3.3 Socio-cultural circumstances

In socio-cultural terms, the later Roman and early Byzantine periods are marked by a culturally mixed everyday reality and by the rise of Christianity.

As remarked in Section 3.2, there no longer seems to have been an ethnic division between the Greek and Egyptian cultures at this point, but rather a Graeco-Egyptian or Egypto-Greek culture in everyday life. This is reflected, for example, in the large number of loanwords describing aspects of everyday life. There are both Greek loanwords in Egyptian (see most extensively Förster 2002) and Egyptian loanwords in Greek (Torallas Tovar 2004a, 2004b, 2007, 2017).

Notably, neither Greek nor Egyptian regularly adopted function words from the respective other language. Matras (2015) explains that the borrowing of functional (especially inflectional) morphology is dispreferred in bilingual settings because functional morphology plays an integral role in structuring communicative interaction. He argues that the borrowing of inflectional morphology in particular is 'part of a process of re-negotiating identity' (Matras 2015: 24). This kind of renegotiation of linguistic identity was apparently not happening.[17]

At the beginning of the fourth century, the *Edict of Milan* (AD 313) granted legal status to Christianity and in AD 380, the *Edict of Thessalonica* made Chris-

17. One-offs exist, for example the possessive *pa-* in *P. Neph.* 12.11 ⲁⲥⲡⲁ̀ⲍⲟⲙⲁⲓ ⲧ̀Ⲱⲣ ⲡⲁ Ⲧⲁⲙⲟⲩⲣⲱ· 'I greet Hor, the one from Tahmouro'. Yet, these are code-switches, that is unnaturalised imports, rather than borrowings, naturalised imports (C. Hoffmann 1991: 99–100; Myers-Scotton 2006: 253–60 on ad hoc borrowings and one-off borrowings).

tianity the official religion. Christianity is believed to have radiated out from the urban centres in particular, that is it spread gradually rather than explosively (interestingly Depauw & Clarysse 2013). As mentioned, religious institutions were gaining in political power (cf. Section 3.1) and were taking over in the educational domain (cf. Section 3.2). Especially with the fourth-century edicts, the traditional Egyptian polytheistic religion went on a steep downward trend (Houston, Baines & Cooper 2003). Thus, Christian institutions and Christian thought became increasingly prevalent in all spheres of life (including art, architecture, literature, education, administration).

With regard to borrowing, the inherited word for a common concept such as 'father' survived in the everyday language: Classical Egyptian  *jt* – Demotic  *it* – Coptic ⲉⲓⲱⲧ (S) *eiōt* / ⲓⲱⲧ (B) *iōt*. By contrast, the Greek word πατήρ / ⲡⲁⲧⲉⲣ *pater* was reserved for the religious sphere or other specialised contexts, such as epistolary formulae. Thus, loanwords from Greek were an enrichment rather than a substitution.

4. Sociolinguistic approach: Creation?

A sociolinguistic approach means considering the interaction between a language variety and its social surroundings (its *Sitz im Leben*). Relevant factors are, for example, the political and societal settings, the socio-economic, educational and societal background of speakers and the domains of life in which a language is societally licenced. The sociolinguistic approach can be conferred to writing systems as three modern examples illustrate. These also show the range of reasons that can underlie the choice of a writing system.

Firstly, Kazakhstan, a country that has recently gained independence, has implemented policies to replace the Cyrillic alphabet by the Latin alphabet, a clear move away from the former Russian rulers (Tolipov 2017). Thus, a political aim results in a policy regulating the use of writing systems. Secondly, debates are ongoing whether the Indian scripts will survive or be replaced by the Latin alphabet especially in the context of technical and infrastructural support for these scripts, such as the availability of software for these scripts (Kurzon 2010; Pillalamarri 2019). This is a rather socio-political factor as it concerns the provision of resources for a writing system. Thirdly, Brehmer (2015) investigated the use of the Cyrillic alphabet as opposed to the Latin alphabet on an online platform for students (StudiVZ). The platform is a social network run from Berlin, Germany, and intended to facilitate communication between students from all parts of the country, thus including international students. Brehmer found that

the choice of writing system was conditioned not only by identity-related issues but also by practical advantages, such as ease of writing and comprehension by bilinguals who are not biscriptal. The issue of comprehensibility is particularly relevant in bilingual settings, such as late Roman and early Byzantine Egypt.

The following sections consider three sociolinguistic hypotheses that have been advanced with regard to the demise of the inherited Egyptian writing system and the rise of the Coptic alphabet. While relevant, the sociolinguistic factors considered cannot on their own explain the fundamental change of writing systems. The missing piece in the jigsaw puzzle is discussed in Section 5.

4.1 Domains of usage (text type and functionality)

One aspect that is key in the sociolinguistic approach is the type of text, in terms of genre and register, which a phenomenon of interest appears in. The genre of a text is a culturally determined category, which imposes certain requirements on the text. For example, you would not use highly formal language in a novel. The register of a text is its embedding in the surrounding social, political, societal and cultural contexts. For example, you are unlikely to use many passives in a personal letter as passives are rather a feature of more formal, official language (Biber & Conrad 2009). Concretely, what is of interest here is which types of texts contain the earliest attempts of using the Greek alphabet to write Egyptian because the type of text can tell us something about the writers of these texts and can thus help us identify the likeliest context in which the rise of the Coptic alphabet originated. These writers apparently saw a need to go beyond their traditional resources.[18]

One reason for this could be that the old (Demotic) writing system was no longer functional, that is fit to represent the current state of the language and especially its pronunciation. Dieleman (2005: 71) founded this hypothesis on the fact that the earliest uses of the Coptic alphabet appear in the context of magical spells and glosses. Presumably the correct pronunciation was important in order to achieve the desired result with the spell.[19] Based on the same material, Stadler (2008: 159–60) reached the opposite conclusion, namely that the magical papyri exhibit a mixture of Greek and Demotic resulting from an intense contact situation. In his opinion, this shows that Demotic was still functional for the current state of the language. Both these arguments seem plausible on their own,

18. One could interpret the fact that they did not adopt the Greek alphabet but developed an Egyptian alphabet as them feeling a need to use Egyptian writing in certain domains of usage, such as literature and personal letters.

19. An anonymous reviewer flagged to me that this is especially true for foreign names and loan words.

yet contradictory to each other. Consequently, we would need additional evidence to decide. However, Quack (2017a: 49–55) has shown more recently that not only are the magical papyri not the first and only place where Greek letters were used to write Egyptian, but also that the magical papyri show a system of 'alphabetic Demotic' and Greek writing only, without any additional Demotic-derived signs. Thus, any hypothesis founded on the magical papyri alone cannot capture the whole truth.

The question of the functionality of the writing system for the current stage of the language can be approached from a different angle. Greek loanwords were in common use by the later Roman period. The Demotic script, unlike the Greek alphabet, does not notate vowels consistently and assigns determinatives to words. When importing a Greek word and committing it to writing, the scribe was faced with two challenges, to eliminate the vowels[20] while ensuring that the representation of the word remained unambiguous (Crellin 2018 on writing vowels) and to assign an appropriate determinative. Clarysse (2013) lists 114 Greek loanwords in Demotic and the determinatives which scribes assigned to them. This is a small number of loanwords compared to what is notated in Coptic. The small number may be the result of the practical difficulty of transferring a Greek word into Egyptian. In a bilingual environment, this seems a disadvantage.[21]

4.2 Social networks (communities of practice)

A second aspect that is important in the sociolinguistic approach is the connection(s) between users of a language and a writing system. These connections have been conceptualised by Milroy and Milroy (2012) as social networks. In essence, someone's social network is the number of people someone gets in touch with and the people these people get in touch with and so on. Social networks map the existence and kind of connections between users of a language and a writing system. From a slightly different angle, social networks can be viewed as communities of practice, in that knowledge and/or experience can be shared when people interact (Unwin, Hughes & Jewson 2007). Schools are a prime example of communities of practice. That communities of practice existed in late antique Egypt is shown, for example, by Clarysse's observation on writing tools. In evidence dating from the mid-third century BC (261–240 BC), Greek scribes favoured a reed pen, whereas

20. Vowel writing was possible to a limited extent only as mentioned above.

21. I do not believe that the number of Greek loanwords suddenly exploded coincidentally with the introduction of the Coptic alphabet. It seems more likely that Greek loanwords gradually increased over time but were difficult to notate in Demotic and were disfavoured by the conservative standard-language doctrine that seems to have been attached to Demotic writing.

Egyptian scribes preferred a pen made of rush (Clarysse 1993: 188). Apparently, there were two schools of writing that passed on their knowledge about writing utensils.

In the context of social networks and communities of practice, the hypothesis has been advanced that the Coptic alphabet emerged as an in-group writing system. This is based on the concept of an in-group language variety, which can develop in close-knit social networks. In a close-knit social network, the number of interlocutors is strictly limited and in extreme cases, there may be a desire to exclude everyone that is not part of the network. One way to mark oneself as different and exclude outsiders from communicative interactions is to modify one's means of communication, that is one's language variety, to such an extent that it becomes hardly or not at all comprehensible to an outsider who has not been familiarised with the peculiarities of this variety (Hickey 2013).

Candidates for in-groups include most prominently the early Christians (Torallas Tovar 2004b: 59; Torallas Tovar & Vierros 2019: 488) and non-mainstream religious communities such as the Manichaeans (Gardner 2006; Gardner et al. 1999; Shisha-Halevy 2002; Zakrzewska 2015). Both groups are thought to have had an interest in an in-group variety because they faced criticism from the majority of the population and consequently somewhat needed to protect themselves from the outside world. The amount of criticism rapidly decreased for the Christians with the political and societal developments of the early Byzantine period, but must rather have increased for the Manichaeans due to the same developments.

There are two problems with situating the origins of the Coptic alphabet in an in-group context. Firstly, as the structure of the Coptic alphabet shows, its creators were able to draw on the Greek and Egyptian writing systems current at the time. Consequently, the only in-group we could hypothesise would be a thoroughly bilingual and biscriptal one, such as the urban centres of the Nile valley (Choat 2012: 588). Secondly, the range of letter shapes and the varying number of additional graphemes discussed above makes a decentralised development of the Coptic alphabet likely. Quack (2017a: 73) suggests one community of practice for the South of Egypt or even Kellis in particular; Bagnall (2005) suggests that the early Christians were one community of practice. Their version of the Coptic alphabet won out in the end due to their success in the period of the promotion of the writing system (see also Richter 2009).[22] In essence, we could only hypoth-

22. A fully functional version of the Coptic alphabet existed around 100 AD according to Quack (2017a: 61) and thus predates Christianity taking root in Egyptian society. Thus, older roots of the alphabet are likely.

esise a range of communities of practice being at the heart of the origins of the Coptic alphabet, but not one in-group.

4.3 Linguistic identity (in light of political fragmentation)

The choice of a language is closely tied to issues of identity especially in a bilingual setting. In essence, the choice of one language or the other shows someone's loyalty to the culture and discourse associated with this language (Hamers & Blanc 2000: 9; Matras 2009: 53–57). In this respect, language choice is emblematic. The relationship between language and identity is reciprocal. As Lawler (2008: 7) remarks, 'far from identities being formed in opposition to the social world they are (…) formed by the social world.' Thus, someone's choice of language reflects their choice of identity in any given situation; at the same time, their choice of language is conditioned by the social surroundings. Because of the close relationship between language and issues of identity, groups of people that want to demarcate their identity often choose to adopt their own language variety. For example, in the United Kingdom, there are attempts to revive local languages such as Welsh in order to give the relevant group of people the opportunity to highlight their local identity.

Depauw (2012) extends identity-related issues to the choice of a writing system when discussing the stele of Cornelius Gallus (29 BC). On this stele, inscriptions in Greek, Latin and Hieroglyphs appear, yet the Demotic script is not represented (Hoffmann, Minas-Nerpel & Pfeiffer 2009). Depauw takes the omission of the Egyptian everyday script as evidence for the suppression of the local identity. Hieroglyphs, which were included on the stele, were emblematic for the traditional culture but were detached from everyday life.

In the context of the political fragmentation of the later Roman and early Byzantine periods, it has been discussed whether there was a rise of local languages and writing systems as an indication of strengthened local identities in rebellion against the formerly superimposed imperial identity. However, opinions differ. Choat (2009: 354) considers this a feasible explanation for why the Coptic alphabet came into being when the Roman empire was on a downward trend. Clackson (2010: 94) sees no connection between the emergence of the Coptic alphabet and any nationalistic tendencies.

Fournet (2019) has shown that Egyptian was gaining in importance from the fourth century onwards and especially in the sixth and seventh centuries because Egyptian became acceptable in domains of life that were formerly Greek dominated, such as the legal sphere. It seems plausible to posit that the beginning of this trend can be found around the time of the first attestations of the Greek alphabet used to write Egyptian. Quack's (2017a) evidence points towards a fully func-

tional system of using Greek graphemes to write Egyptian from at the very latest AD 100. This is temporally close to the official relaxation of linguistic policies in AD 212 (cf. Section 3). Whether or not this gaining in importance is to be linked to nationalistic tendencies is unclear. Kraus' (2000) observation that ethnic divisions were no longer relevant from the Roman period onwards would in any case indicate that such tendencies, if present, pertain to the whole population of Egypt rather than only to its ethnically Egyptian part.

5. Psycholinguistic approach: Evolution?

Section 4 showed that there are many reasons that can underlie the choice of a writing system, but that none of these can fully explain the fundamental change of writing systems in late Roman and early Byzantine Egypt. The missing piece in the jigsaw puzzle is to be gained from a psycholinguistic approach.

A modern example can illustrate the relevant cognitive factors. Asfaha et al. (2009) found that the use of the syllabic Ge'ez script as opposed to the Latin alphabet for four African languages advantages learners in the initial stages as the grain size in Ge'ez is larger.[23] We have here a parallel to the situation in Egypt, one language, two available writing systems and social factors (of tradition) along with practical factors (of education) influencing the choice of a writing system. The following sections outline the psycholinguistic grain size theory as well as how it interacts with diachronic phonological change in the case of Egyptian.

5.1 Cognitive aspects: Grain size theory

Baroni (2011) debunks the superiority of the alphabet as an ethnocentric prejudice and draws attention to the fact that each language has its own fit in relation to the perfect writing system. This fit can be explained by the interaction of a language's phonological structure and the grain size of the writing system.

Ziegler and Goswami's (2005) Psycholinguistic Grain Size Theory captures the difference in what unit of sound and/or meaning is mapped onto a grapheme. The size of the unit that is mapped onto a grapheme is the grain size. For instance, in alphabetic scripts the grain size is a phoneme and in syllabic scripts a syllable. The Grain Size Theory holds that the grain size for any writing system is determined by the interaction of functional pressures, that is pressures towards smaller, orthographically less complex units, linguistic pressures, that is pressures towards larger, phonologically more accessible units, and statistical pressures, that is pres-

23. At later stages of learning, however, this advantage seems to level out.

sures towards units that are maximally consistent (Ziegler & Goswami 2005: 20). Asfaha et al. (2009) summarise these pressures neatly under the terms granularity, availability and consistency.

Based on empirical data, Perfetti and Dunlap (2008) find that the mapping of graphemes on units of sound and/or meaning differs between language-writing system pairs and that people learn what kind of unit is mapped onto a grapheme for their pair. Hirshorn and Fiez (2014) find, working with artificial orthographies, that the grain size indeed underlies cognitive and neural differences in reading acquisition and skill. Lallier and Carreiras (2018) confirm this hypothesis for bilinguals.

Cross-linguistically, there seems to be a trade-off between a multifunctional form in acquisition vs comprehension and many forms in acquisition vs comprehension. For example, from the perspective of acquisition, Perfetti and Verhoeven (2017a: 458, 460, 465) draw attention to the fact that learning a number of characters sufficient to use the Chinese script successfully can take children more than three years, whereas the characters of an alphabetic script are acquired much more quickly. From the perspective of comprehension, Asfaha et al. (2009) find when comparing alphabetic and syllabic scripts used for four African languages that the larger grain size of syllabic scripts comes as an advantage at elementary levels of script acquisition and this seems to offset the disadvantage of the large inventory of signs. The reason for this seems to be the availability of the syllable, which is not the case in alphabetic scripts.

5.2 Phonological aspects

Phonology is relevant to the fit of a writing system to a language and to the cognitive process of decoding graphemes when reading. Firstly, the phonology of languages differs fundamentally, with English and German for instance having many complex syllables (Ziegler & Goswami 2005: 19) unlike Japanese. Thus, a syllabic script would be a better fit for languages like Japanese, whereas languages like English and German may fare better with an alphabetic script. While parameters other than the phonology of a language also play a role, for example, social and political pressures, it is noteworthy that Perfetti and Verhoeven (2017a: 457) find that scripts usually develop naturally and adapt instead of being created artificially, for example through a policy. Secondly, the Universal Phonological Principle holds that phonological aspects are activated before lexical aspects when reading (Baroni 2011). Thus, the units of the mapping between function and form, that is language and grapheme, are likely to have a phonological element to them.

While Classical Egyptian was written with a supraphonemic writing system, which was graphically modified several times, Coptic is written with an alpha-

betic (phonemic) writing system. Was this change supported by phonological developments of the language?

Loprieno (1995: 36–37) posits open, closed and doubly closed[24] syllables for earlier Egyptian (ca. 2800–2150 BC) with the foot as the basic stress unit and the stress being necessarily on one of the last two syllables of a word. For later Egyptian (ca. 1550– 1000 BC), he notes that doubly-closed and unstressed open syllables became more prominent (Loprieno 1995: 39–40). For Coptic (from the 2nd c. AD onwards), the syllable structure is suddenly much better documented due to the nature of the writing system. Obvious phonological changes are the reduction of short vowels in pretonic open syllables to schwa and the (subsequent) development of biconsonantal onsets. Schwa is sometimes indicated by a diacritic, a superliteral dot in Bohairic and Oxyrhynchite and a superlinear stroke in Sahidic, for instance ⲛ̀ⲧⲟϥ *ᵉntof* and ϣⲱⲧⲙ̀ *sōtᵉm* (Allen 2013: 13).[25] Note also that several Coptic consonants are syllabic (Allen 2013: 13). By and large, the inventory of open syllables became more varied and open syllables became more frequent over time, primarily due to the loss of final consonantal phonemes (Allen 2013: 24).

The Coptic alphabet reflects certain phonological changes. For example, the distinction between the four /h/ sounds of Classical Egyptian, represented by four different graphemes until Demotic, faded in the second century AD (Quack 2017a: 48). Thus, the graphemes that represented sounds that had fallen together, etc. were no longer needed and could be either dropped or functionally reinterpreted. With regard to the latter option, we observe regional differences between the Demotic graphemes that the creators of the Coptic alphabet chose to adapt for the remaining /h/ sounds of the language.

The situation is comparable to the one of Greek speakers adopting the Phoenician alphabet around the eighth century BC. Several sounds that were represented by graphemes in this alphabet were not needed in Greek and the graphemes therefore dropped out of use or were functionally reinterpreted. For example, the Phoenician alphabet had the sonants Ṣade and Šin (Daniels 2018: 150), neither of which was adopted in Ionic or Attic, the two dialects that would prove most prominent in the long term. The Phoenician alphabet consisted of graphemes representing consonants. When it was adapted for the Greek language, Aleph was reinterpreted as a vowel and so was Het, to name only two examples (Jeffery 1990).

24. The existence of doubly-closed syllables is challenged by Quack (2007).

25. Debate about the superlinear stroke is ongoing (Peust 1999: 61–65).

5.3 Coptic

If a phonological system changes, this affects how this system is best mapped onto a writing system. Egyptian phonology changed significantly over the centuries so that what was a good fit for earlier Egyptian was no longer a good fit for later Egyptian. The issue of 'fit' can be conceptualised with the grain size theory.

What happened in the case of the transition from Demotic to Coptic is a change from a mixed writing system, in that graphemes could represent phonemic or supraphonemic units, to an alphabetic writing system, in which graphemes represent phonemes. The phonological changes in Egyptian seem to have made this change possible if not even preferable. The increase in the repertoire of open syllables and the elision of short vowels in short open syllables meant that former syllables were reduced in many environments. The above-mentioned biconsonantal onsets that developed are just one environment which are problematic in a supraphonemic writing system.

The inherited Egyptian writing system did not specify clearly the location of vowels (see Section 2.1). Moreover, vowel quality plays a significant role in the Coptic morphosyntax. For instance, ⲕⲱⲧ *kōt* 'to form, create' (indicative) vs ⲕⲏⲧ *kēt* 'to be formed, be in a shape' (stative). Finally, newly developed consonant clusters might have required an update of the sign inventory, either an update of form-function pairings or an expansion of the inventory.

Most relevant phonological changes in Egyptian date from the Demotic period, centuries before the Coptic alphabet emerged. Yet, writing systems do not change abruptly when the phonology of a language changes but there is significant latency involved due to writing systems being bound to cultural, social and educational aspects. For instance, a new writing system would not carry the same cultural significance as an inherited one and educational support needs to be adjusted. Demotic has often been described as an out-dated/conservative writing system the users held on to (Depauw 1997: 36; Oréal 1999: 295; Richter 2009: 403; Thompson 2009: 399), most likely due to cultural and social reasons. Thus, the phonological trigger alone is not sufficient to set a change in motion, but only in combination with social and cultural factors.[26]

What would be interesting to explore but goes beyond the scope of the present paper is what impact changes in the educational system had. We noted above that a limited number of graphemes can be acquired more quickly than a larger number of graphemes, but that there is a trade-off, in that faster acquisition of the graphic inventory does not automatically mean that full mastery of the writing

26. This is the widely discussed interaction between linguistic and extra-linguistic / attitudinal factors (Thomason 2001).

system is achieved more quickly. Further investigation of educational contexts, including informal ones, would be needed to shed light on this aspect.

6. Summary and conclusion

This paper emphasises that there is no fixed one-to-one correspondence between a language and a writing system, which opens up the opportunity of changing writing systems (cf. Section 1). Egyptian underwent a fundamental change of writing systems in the later Roman period with the shift towards an alphabetic writing system. The underlying model is the Greek alphabet, yet this was modified with regard to the shape and inventory of graphemes (cf. Section 2). The socio-political circumstances of the period in question can account for the Greek alphabet serving as a model (cf. Section 3).

The sociolinguistic approach can shed light on the circumstances in which these earliest uses of the Greek alphabet to write Egyptian are to be situated, explain why one community of practice prevailed over others in the end and why the inherited writing systems fell out of use, in essence by analysing people's attitudes (cf. Section 4).[27] Yet, the sociolinguistic approach cannot fully explain a structural change as fundamental as the one from a supraphonemic to a phonemic writing system. The missing piece in the jigsaw puzzle is the cognitive aspect of the interaction of the grain size of a writing system with the phonology of a language. Egyptian had undergone changes to its syllable structure by the later Roman period, so that the shift to an alphabetic writing system had become viable (cf. Section 5).

The phonological changes that made preferable using a writing system with a grain size smaller than the one of the inherited Egyptian writing systems are the evolutionary shift Quack (2017a) hinted upon at the end of his empirical study of the origins of the Coptic alphabet. The experimentation with the shape and number of additional graphemes in local communities of practice is the creative element involved in the emergence of the Coptic alphabet. Thus, evolution and creation complement each other resulting in the first Egyptian alphabet.

27. The critical mass hypothesis holds that when the number of people who are able and willing to use a script falls below a certain threshold, a script gradually disappears from the scriptal landscape (Stadler 2008: 166–67).

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